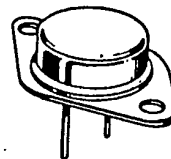


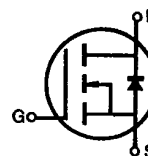
**IRF440/441/442/443****N-CHANNEL  
POWER MOSFETS****FEATURES**

- Low  $R_{DS(on)}$  at high voltage
- Improved inductive ruggedness
- Excellent high voltage stability
- Fast switching times
- Rugged polysilicon gate cell structure
- Low input capacitance
- Extended safe operating area
- Improved high temperature reliability
- TO-3 package (High voltage)

TO-3

**PRODUCT SUMMARY**

| Part Number | $V_{DS}$ | $R_{DS(on)}$  | $I_D$ |
|-------------|----------|---------------|-------|
| IRF440      | 500V     | 0.85 $\Omega$ | 8.0A  |
| IRF441      | 450V     | 0.85 $\Omega$ | 8.0A  |
| IRF442      | 500V     | 1.10 $\Omega$ | 7.0A  |
| IRF443      | 450V     | 1.10 $\Omega$ | 7.0A  |

**MAXIMUM RATINGS**

| Characteristic                                                             | Symbol         | IRF440     | IRF441 | IRF442 | IRF443 | Unit                   |
|----------------------------------------------------------------------------|----------------|------------|--------|--------|--------|------------------------|
| Drain-Source Voltage (1)                                                   | $V_{DS}$       | 500        | 450    | 500    | 450    | Vdc                    |
| Drain-Gate Voltage ( $R_{GS}=1.0M\Omega$ ) (1)                             | $V_{DGR}$      | 500        | 450    | 500    | 450    | Vdc                    |
| Gate-Source Voltage                                                        | $V_{GS}$       | $\pm 20$   |        |        |        | Vdc                    |
| Continuous Drain Current $T_C=25^\circ C$                                  | $I_D$          | 8.0        | 8.0    | 7.0    | 7.0    | Adc                    |
| Continuous Drain Current $T_C=100^\circ C$                                 | $I_D$          | 5.0        | 5.0    | 4.0    | 4.0    | Adc                    |
| Drain Current—Pulsed (3)                                                   | $I_{DM}$       | 32         | 32     | 28     | 28     | Adc                    |
| Gate Current—Pulsed                                                        | $I_{GM}$       | $\pm 1.5$  |        |        |        | Adc                    |
| Total Power Dissipation @ $T_C=25^\circ C$<br>Derate above $25^\circ C$    | $P_D$          | 125<br>1.0 |        |        |        | Watts<br>W/ $^\circ C$ |
| Operating and Storage<br>Junction Temperature Range                        | $T_J, T_{stg}$ | -55 to 150 |        |        |        | $^\circ C$             |
| Maximum Lead Temp. for Soldering<br>Purposes, 1/8" from case for 5 seconds | $T_L$          | 300        |        |        |        | $^\circ C$             |

Notes: (1)  $T_J=25^\circ C$  to  $150^\circ C$ (2) Pulse test: Pulse width  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$ 

(3) Repetitive rating: Pulse width limited by max. junction temperature



**IRF440/441/442/443****N-CHANNEL  
POWER MOSFETS****ELECTRICAL CHARACTERISTICS** ( $T_C=25^\circ\text{C}$  unless otherwise specified)

| Characteristic                                  | Symbol       | Type             | Min | Typ  | Max  | Units    | Test Conditions                                                                                                                                      |
|-------------------------------------------------|--------------|------------------|-----|------|------|----------|------------------------------------------------------------------------------------------------------------------------------------------------------|
| Drain-Source Breakdown Voltage                  | $BV_{DSS}$   | IRF440           | 500 | —    | —    | V        | $V_{GS}=0V$                                                                                                                                          |
|                                                 |              | IRF442           | —   | —    | —    | —        | —                                                                                                                                                    |
|                                                 |              | IRF441<br>IRF443 | 450 | —    | —    | V        | $I_D=250\mu A$                                                                                                                                       |
| Gate Threshold Voltage                          | $V_{GS(th)}$ | ALL              | 2.0 | —    | 4.0  | V        | $V_{DS}=V_{GS}$ , $I_D=250\mu A$                                                                                                                     |
| Gate-Source Leakage Forward                     | $I_{GSS}$    | ALL              | —   | —    | 100  | nA       | $V_{GS}=20V$                                                                                                                                         |
| Gate-Source Leakage Reverse                     | $I_{GSS}$    | ALL              | —   | —    | -100 | nA       | $V_{GS}=-20V$                                                                                                                                        |
| Zero Gate Voltage Drain Current                 | $I_{DSS}$    | ALL              | —   | —    | 250  | $\mu A$  | $V_{DS}=\text{Max. Rating}$ , $V_{GS}=0V$                                                                                                            |
|                                                 |              |                  | —   | —    | 1000 | $\mu A$  | $V_{DS}=\text{Max. Rating} \times 0.8$ , $V_{GS}=0V$ , $T_C=125^\circ\text{C}$                                                                       |
| On-State Drain-Source Current (2)               | $I_{D(on)}$  | IRF440           | 8.0 | —    | —    | A        | $V_{DS} > I_{D(on)} \times R_{DS(on) \text{ max.}}$ , $V_{GS}=10V$                                                                                   |
|                                                 |              | IRF441           | —   | —    | —    | —        |                                                                                                                                                      |
|                                                 |              | IRF442<br>IRF443 | 7.0 | —    | —    | A        |                                                                                                                                                      |
| Static Drain-Source On-State Resistance (2)     | $R_{DS(on)}$ | IRF440           | —   | 0.6  | 0.85 | $\Omega$ | $V_{GS}=10V$ , $I_D=4.0A$                                                                                                                            |
|                                                 |              | IRF441           | —   | —    | —    | —        |                                                                                                                                                      |
|                                                 |              | IRF442<br>IRF443 | —   | 1.0  | 1.1  | $\Omega$ |                                                                                                                                                      |
| Forward Transconductance (2)                    | $g_{fs}$     | ALL              | 4.0 | 6.5  | —    | S        | $V_{DS} > I_{D(on)} \times R_{DS(on) \text{ max.}}$ , $I_D=4.0A$                                                                                     |
| Input Capacitance                               | $C_{iss}$    | ALL              | —   | 1200 | 1600 | pF       | $V_{GS}=0V$ , $V_{DS}=25V$ , $f=1.0\text{MHz}$                                                                                                       |
| Output Capacitance                              | $C_{oss}$    | ALL              | —   | 230  | 350  | pF       |                                                                                                                                                      |
| Reverse Transfer Capacitance                    | $C_{rss}$    | ALL              | —   | 65   | 150  | pF       |                                                                                                                                                      |
| Turn-On Delay Time                              | $t_{d(on)}$  | ALL              | —   | —    | 35   | ns       | $V_{DD}=0.5BV_{DSS}$ , $I_D=4.0A$ , $Z_\theta=4.7^\circ\text{C/W}$<br>(MOSFET switching times are essentially independent of operating temperature.) |
| Rise Time                                       | $t_r$        | ALL              | —   | —    | 15   | ns       |                                                                                                                                                      |
| Turn-Off Delay Time                             | $t_{d(off)}$ | ALL              | —   | —    | 90   | ns       |                                                                                                                                                      |
| Fall Time                                       | $t_f$        | ALL              | —   | —    | 30   | ns       |                                                                                                                                                      |
| Total Gate Charge (Gate-Source Plus Gate-Drain) | $Q_g$        | ALL              | —   | 34   | 60   | nC       | $V_{GS}=10V$ , $I_D=10A$ , $V_{DS}=0.8 \text{ Max. Rating}$<br>(Gate charge is essentially independent of operating temperature.)                    |
| Gate-Source Charge                              | $Q_{gs}$     | ALL              | —   | 6.0  | —    | nC       |                                                                                                                                                      |
| Gate-Drain ("Miller") Charge                    | $Q_{gd}$     | ALL              | —   | 28   | —    | nC       |                                                                                                                                                      |

**THERMAL RESISTANCE**

|                     |            |     |   |     |     |     |                                            |
|---------------------|------------|-----|---|-----|-----|-----|--------------------------------------------|
| Junction to Case    | $R_{thJC}$ | ALL | — | —   | 1.0 | K/W |                                            |
| Case-to-Sink        | $R_{thCS}$ | ALL | — | 0.1 | —   | K/W | Mounting surface flat, smooth, and greased |
| Junction-to-Ambient | $R_{thJA}$ | ALL | — | —   | 30  | K/W | Free Air Operation                         |

Notes: (1)  $T_C=25^\circ\text{C}$  to  $150^\circ\text{C}$ (2) Pulse test: Pulse width  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$ 

(3) Repetitive rating: Pulse width limited by max. junction temperature



SAMSUNG SEMICONDUCTOR

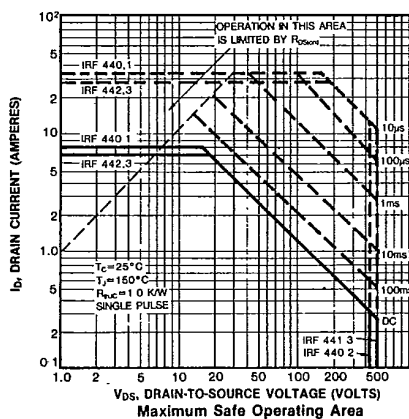
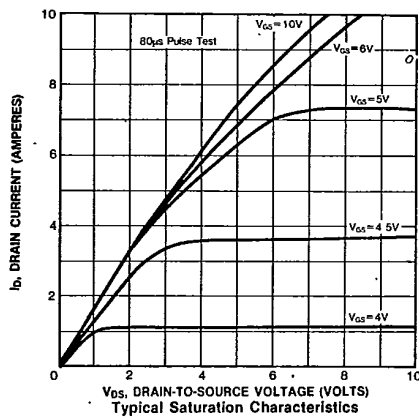
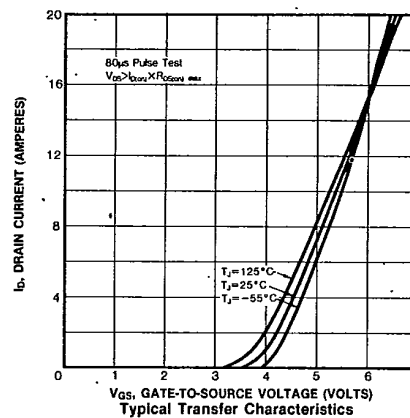
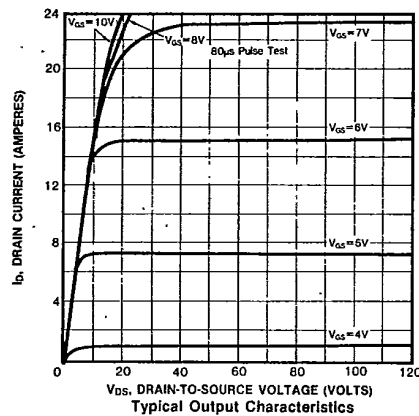
## IRF440/441/442/443

N-CHANNEL  
POWER MOSFETS

## SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS

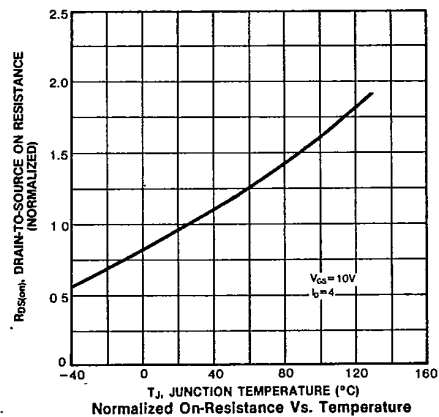
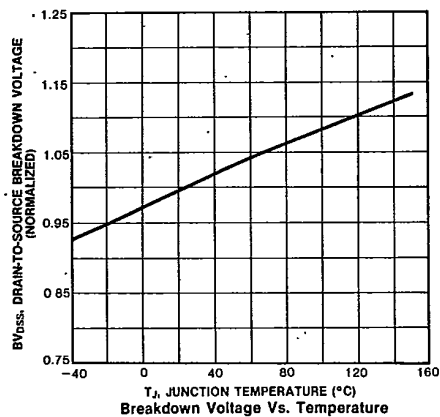
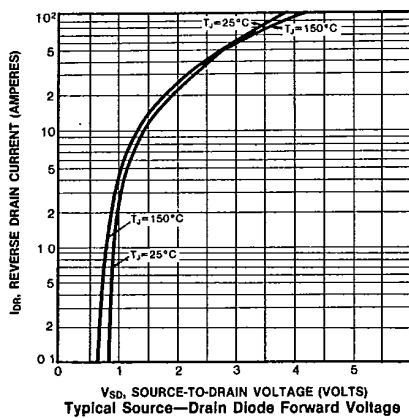
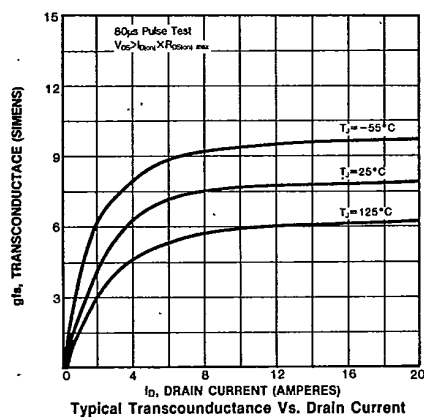
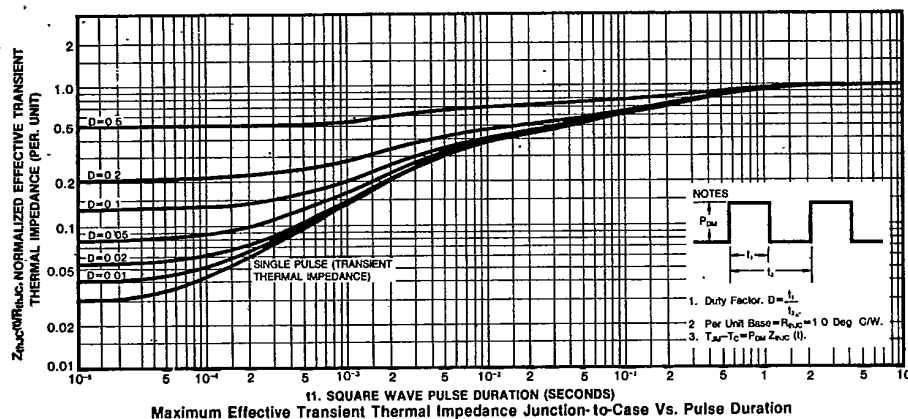
| Characteristic                            | Symbol   | Type   | Min | Typ  | Max | Units | Test Conditions                                                                  |
|-------------------------------------------|----------|--------|-----|------|-----|-------|----------------------------------------------------------------------------------|
| Continuous Source Current<br>(Body Diode) | $I_S$    | IRF440 | —   | —    | 8.0 | A     | Modified MOSFET symbol<br>showing the integral<br>reverse P-N junction rectifier |
|                                           |          | IRF441 | —   | —    | 8.0 | A     |                                                                                  |
|                                           |          | IRF442 | —   | —    | 7.0 | A     |                                                                                  |
|                                           |          | IRF443 | —   | —    | 7.0 | A     |                                                                                  |
| Pulse Source Current<br>(Body Diode) (3)  | $I_{SM}$ | IRF440 | —   | —    | 32  | A     |                                                                                  |
|                                           |          | IRF441 | —   | —    | 32  | A     |                                                                                  |
|                                           |          | IRF442 | —   | —    | 28  | A     |                                                                                  |
|                                           |          | IRF443 | —   | —    | 28  | A     |                                                                                  |
| Diode Forward Voltage (2)                 | $V_{SD}$ | IRF440 | —   | —    | 2.0 | V     | $T_C=25^\circ\text{C}$ , $I_S=8.0\text{A}$ , $V_{GS}=0\text{V}$                  |
|                                           |          | IRF441 | —   | —    | 2.0 | V     | $T_C=25^\circ\text{C}$ , $I_S=8.0\text{A}$ , $V_{GS}=0\text{V}$                  |
|                                           |          | IRF442 | —   | —    | 1.9 | V     | $T_C=25^\circ\text{C}$ , $I_S=7.0\text{A}$ , $V_{GS}=0\text{V}$                  |
| Reverse Recovery Time                     | $t_{rr}$ | ALL    | —   | 1100 | —   | ns    | $T_J=150^\circ\text{C}$ , $I_F=8.0\text{A}$ , $dI_F/dt=100\text{A}/\mu\text{s}$  |

Notes: (1)  $T_J=25^\circ\text{C}$  to  $150^\circ\text{C}$  (2) Pulse test: Pulse width  $\leq 300\mu\text{s}$ , Duty Cycle  $\leq 2\%$   
 (3) Repetitive rating: Pulse width limited by max. junction temperature



SAMSUNG SEMICONDUCTOR

## IRF440/441/442/443

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